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# 基研研究会「複雑性と非加法性-統計力学の新展開」

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## 基研研究会「複雑性と非加法性 —統計力学の新展開」

International Workshop on Complexity and Nonextensivity:

New Trends in Statistical Mechanics (CN-Kyoto)

開催期間：2005 年 3 月 14 日-18 日

開催場所：京都大学基礎物理学研究所湯川記念館

Chairpersons: 阿部純義（筑波大学大学院数理物質科学研究科）

阪上雅昭（京都大学大学院人間・環境学研究科）

### 研究会の主旨と成果

自然科学・社会科学・情報科学の諸分野と学際的に関わる複雑性の科学は、要素還元主義的アプローチからでは系全体の性質を上手く理解することが出来ないような状況を想定した新しい学問分野である。最近数年間に展開された自己組織化する scale-free なネットワークのトポロジーや small world などについての研究の重要な発展は、複雑系の背後に共通する数学的論理の存在を示している。一方、統計力学の基礎研究においては、「カオスの縁」におけるエルゴード性の破れや相空間中に自己組織化される系のマルチフラクタル配位によって引き起こされるエントロピーの加法性の破れとそれにとまなう Boltzmann-Gibbs 統計力学の非加法的拡張の研究が盛んに行なわれ、種々の複雑系の統計的性質の記述に成功しつつある。ここで取り扱われる対象は、諸科学においてしばしば見られる、非平衡定常性・遅い緩和・ベキ則性・カタストロフなどの概念を含む広範なものである。経済指数、地震、インターネット、WWW、生態系、細胞内生体高分子ネットワーク、疫病伝染などはその典型的な例である。

目下、上述の複雑ネットワーク理論と非加法的統計力学との間の興味深くかつ驚くべき関連が得られつつある。そこで本研究会は、この「関連」を数理科学的実験的現象論的に明らかにすることを目的とした。

21 世紀の科学に求められるひとつの重要事項は、世界を有機的かつホーリステ

ィックにとらえ理解することである。このことを視野に入れて、それぞれの領域で第一級の研究を展開している研究者を内外から招き、最近の発展について総括していただいた。また、将来の展望や更なる応用分野の拡大について、参加者間で豊富な議論・討論がもてるような場を提供することを試みた。

研究会は、招待講演者による主要講演と一般講演およびポスターから成った。11ヶ国から、合計50人の参加者を迎え、40件の研究発表がおこなわれた。

文責：阿部純義（筑波大学）

## プログラム

13th (Sunday)	
15:00 -	REGISTRATION at YITP
16:00 -	WELCOME DRINK at YITP

14th (Monday)	
9:00 - 9:10	OPENING ADDRESS
9:10 - 10:10	1. C. Beck (Invited Talk)
10:10 - 10:50	COFFEE
10:50 - 11:50	2. A. Robledo (Invited Talk)
11:50 - 14:00	LUNCH
14:00 - 14:30	3. Hideo Hasegawa
14:30 - 15:00	4. E. Barkai
15:00 - 15:30	5. U. Tirnakli
15:30 - 16:00	COFFEE
16:00 - 16:30	6. H. Suyari
16:30 - 17:00	7. Hiroshi Hasegawa
17:00 - 17:30	8. R. Kawahara

※Session Chairpersons: 1&2: A. Rapisarda, 3-5: A. Taruya, 6-8: A. R. Plastino

15th (Tuesday)	
9:00 - 10:00	1. B. Tadic (Invited Talk)
10:00 - 10:40	COFFEE
10:40 - 11:40	2. R. S. Wedemann (Invited Talk)
11:40 - 14:00	LUNCH
14:00 - 14:30	3. N. Masuda

14:30 - 15:00	4. L. da Silva
15:00 - 15:30	COFFEE
15:30 - 16:00	5. S. Miyazaki
16:00 - 16:30	6. N. Suzuki
16:30 -	POSTER SESSION

※Session Chairpersons: 1&2: C. Tsallis, 3-6: B. Tadic

16th (Wednesday)	
9:00 - 10:00	1. A. Rapisarda (Invited Talk)
10:00 - 10:40	COFFEE
10:40 - 11:40	2. A. Taruya (Invited Talk)
11:40 - 12:10	3. Y. Sota
12:10 -	FREE

※Session Chairperson: 1-3: M. Sakagami

17th (Thursday)	
9:00 - 10:00	1. C. Tsallis (Invited Talk)
10:00 - 10:40	COFFEE
10:40 - 11:40	2. L. Borland (Invited Talk)
11:40 - 14:00	LUNCH
14:00 - 14:30	3. T. Kaizoji
14:30 - 15:00	4. A. Fujihara
15:00 - 15:30	5. S. Goto
15:30 - 16:00	COFFEE
16:00 - 16:30	6. A. Pluchino
16:30 - 17:00	7. W.-C. Man
17:00 - 17:30	8. T. Hasumi
19:00 - 21:00	BUFFET PARTY at Holiday Inn

※Session Chairpersons: 1&2: C. Tsallis, 3-5: A. Robledo, 6-8: Hideo Hasegawa

18th (Friday)	
9:00 - 10:00	1. K. Kaneko (Invited Talk)
10:00 - 10:40	COFFEE
10:40 - 11:40	2. A. R. Plastino (Invited Talk)
11:40 - 12:10	3. A. Ueda
12:10 -	CLOSING

※Session Chairperson: 1-3: S. Abe

## 発表内容

### [1] 口頭発表

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Dynamical approach to superstatistics

Christian Beck

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Mile End Road, London E1 4NS, UK

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Quasistationary states and arrested dynamics near critical attractors in unimodal maps

Alberto Robledo

Instituto de Fisica, Universidad Nacional Autonoma de Mexico,  
Apartado Postal 20-364, Mexico 01000 DF, Mexico

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Nonextensive thermodynamics of a cluster consisting  
of  $M$  Hubbard dimers ( $M = 1, 2, 3$ , and  $\infty$ )

Hideo Hasegawa

Dept. of Physics, Tokyo Gakugei University, 4-1-1 Nukui-kita machi, Koganei,  
Tokyo 184-8501, Japan

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Stochastic non-ergodicity

Eli Barkai

Physics Department, Bar-Ilan University, 52900 Ramat-Gan, Israel

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Nonextensivity at the chaos threshold of the  $z$ -logistic map: Connection between  
the relaxation and the average sensitivity entropic indices

Ugur Tirnakli

Department of Physics, Faculty of Science, Ege University, 35100 Izmir, Turkey

Refined formalism of the maximum entropy principle in Tsallis statistics

Hiroki Suyari

Department of Information and Image Sciences, Faculty of Engineering,  
Chiba University, 1-33 Yayoi-cho, Inage-ku, Chiba-shi, Chiba 263-8522, Japan

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Quantum Fisher information and q-deformed relative entropies: additivity vs nonadditivity

Hiroshi Hasegawa

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1-8-14 Kanda-Surugadai, Chiyoda-ku, Tokyo 101-8308, Japan

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Simulation of stationary states of the two dimensional electron plasma trapped in magnetic field

Ryo Kawahara

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Fukuoka-city, 812-8581, Japan

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Functional networks: Structure of noise and flow

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Complex Networks in Psychological Models

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20550-013, Rio de Janeiro, RJ, Brazil

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On a nongrowing small-world and scale-free network model  
with geographical consideration

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Preferential attachment growth model and nonextensive statistical mechanics

Luciano da Silva  
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Directed network as a chaotic piece-wise linear one-dimensional map  
and its large-deviation properties

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Complex network of seismicity

Norikazu Suzuki  
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Complexity and nonextensivity in Hamiltonian long-range models

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Quasi-equilibrium evolution in self-gravitating  $N$ -body systems

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University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo 113-0033, Japan

Democratic temperature distribution and local virial relation:  
Two hypotheses for self-gravitating systems

Yasuhide Sota

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2-1-1 Ohtuka, Bunkyo-ku, Tokyo, Japan

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Scale-invariant occupation of phase space and additive entropy  $S_q$

Constantino Tsallis

Santa Fe Institute, 1399 Hyde Park Road, Santa Fe, NM, 87501, USA and  
Centro Brasileiro de Pesquisas Fisicas, Xavier Sigaud 150, Rio de Janeiro 22290-180, Brazil

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The dynamics of financial markets: A multi-timescale non-Gaussian model

Lisa Borland

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San Francisco, CA 94104, USA

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A mechanism leading from speculative bubbles to crashes

Taisei Kaizoji

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3-10-2 Osawa, Mitaka, Tokyo, 181-8585 Japan

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Similarity and Probability Distribution Function in Stochastic Processes  
with Multiplicative Interactions

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22-2 Seto, Kanazawa-ku, Yokohama 236-0027, Japan

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Non-universal finite size effects with universal infinite-size free energy  
for the  $\alpha$ -XY model



GOTO Shin-itiro

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Changing opinions in a changing world: A new perspective in sociophysics

Alessandro Pluchino

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Via S. Sofia 64, 95123 Catania, Italy

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The relevance of memory in minority game

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Earthquake generation model exhibiting self-organized criticality:

Relation between fault surface structure and statistical properties

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Biological system as a universal class of steady growth system

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Generalized entropies and the physics of classical and quantum information

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Deviation from local equilibrium distribution in one-dimensional lattice  
dynamical systems

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[2] ポスター発表

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Fundamental theorems on nonextensive entropies

Shigeru Furuichi

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Yamaguchi 756-0884, Japan

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$1/f$  fluctuations at the edge of Hamiltonian chaos

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Collective motion in a Hamiltonian dynamical system with mean field coupling

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Scale-free network with geometrical structures

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The eigenvalue distribution of the time-evolution operator of non-equilibrium systems

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Tokyo 153-8505, Japan

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Anomalous diffusion of cosmic rays in magnetic field turbulence:

Linkage between diffusion statistics and turbulence statistics

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Canonical partition function in anomalous systems described by the  $\kappa$ -entropy

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I-10129 Torino, Italy

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The Boltzmann temperature and Lagrange multiplier in nonextensive  
thermostatistics

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4-12-1 Nakanarusawa, Hitachi, Ibaraki, 316-8511 Japan

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Finite-difference lattice Boltzmann methods of binary fluids

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Thermodynamical and informational structure of superstatistics

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Dynamics of two-sign point vortices in positive and negative temperature states

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